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ABSTRACT

This paper looks at the process of assessment of a computer-enhanced classroom experience during the implementation phase. It utilizes an assessment model based on Rathbun and Goodrum (1994) that suggests multi-methods of data collection. The use of triangulation to answer a research question fits into the proposed multi-method design. This paper reports how assessment was used to measure the effectiveness of the implementation of a multimedia application for use in support of a traditional classroom. The Living Textbook was developed to support a senior level management class in a Recreation and Park Administration program. The instructor identified four instructional goals of the multi-media program. Triangulation techniques included group observations, individual student observations, data based and open ended surveys, and debriefing of instructors. The results suggest that usability/ accessibility were essential precursors to students developing receptivity to the multimedia program. When receptivity was achieved, students valued the program as a contributor to their base of knowledge about the real work world. The use of student workbooks, which allowed opportunities for learning by doing, and in-class discussions in small groups were strongly linked to valuing The Living Textbook. (Contains 10 references.) (Author/SWC)

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ASSESSING THE EFFECTIVENESS OF A COMPUTER-ENHANCED CLASSROOM

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ABSTRACT

This paper looks at the process of assessment of a computer-enhanced classroom experience during the implementation phase. It utilizes an assessment model based on Rathbun and Goodrum (1994) that suggests multi-methods of data collection. The use of triangulation (Denzin, 1978) to answer a research question fits into the proposed multi-method design. The Living Textbook was developed to support a senior level management class in a Recreation and Park Administration program. The instructor identified four instructional goals of the multi-media program. Triangulation techniques included group observations, individual student observations, data based and open ended surveys, and debriefing of instructors. The results suggested that usability/accessibility were essential precursors to students developing receptivity to the multimedia program. When receptivity was achieved students valued the program as a contributor to their base of knowledge about the real work world. The use of student workbooks where opportunities for learning by doing occurred and in-class discussions in small groups were strongly linked to valuing the Living Textbook.

INTRODUCTION

The integration of technology in the classroom environment is becoming more widely accepted throughout postsecondary institutions of higher learning. Hutchison (1995) described the current period as a waning print culture -- a retreat from the Gutenberg galaxy. This description may seem overly optimistic or pessimistic depending upon one's point of view. The investment in technology by higher education institutions, however, is going forward at a rapid pace. The assessment of the effectiveness of computer technology as a part of the classroom environment, however, is in its early stages. Of the 69 papers accepted for this conference, only 3 are included under the topic, "Evaluating On-line Instruction." The authors are not so naive to believe that these are the only 3 papers on evaluation, but the implication remains, conference presenters continue to focus on process and implementation at the expense of assessment. Ehrmann (1996) has suggested, "Thus far, few educators, evaluators, and researchers have paid much attention to educational strategies for using technologies. Too often they've been victims of 'rapture of technologies.'" Assessment of process is critically important to understanding educational outcomes and altering strategies to achieve desired outcomes.

This paper reports how assessment was used to measure the effectiveness of the implementation of a multimedia application for use in support of a traditional classroom. This paper does not address the design process or assessment issues related to it.

THE LIVING TEXTBOOK

The Living Textbook (LT) (http://www.indiana.edu/~tltl/htodcs/projects/mclean.html) project was initially conceived as an effort to bring together the functionality of a computer with the needs of the classroom. The classroom it was designed for was already a paperless classroom. Students received all of their assignments and grades through the world wide web (WWW) and turned in all assignments via a local area network. However, the classroom lecture and discussion format remained the primary teaching method. One of the primary goals of the LT was to provide students with an interactive learning environment that would enhance rather than replace the existing classroom. A second goal of the LT was to build the individual student's base of professional experience. The third goal focused on enriching student understanding of management as a dynamic rather than static process. A fourth goal of the LT project focused on enhancing basic and intermediate computer skills. Using the LT as a foundation, students were also exposed to electronic communications software, the WWW, word processing, spread sheet and graphics software (McLean and Brayley, 1996).

THE ASSESSMENT PROCESS

Rathbun and Goodrum (1994) proposed four issues that pose obstacles to effective evaluation of technologically based and supported instruction. The first, continuous change, refers to the ongoing barrage of new technologies confronting a designer. The second issue is technology focus or the ability of the institution to deliver a developed multimedia program. Third, evaluation in isolation, refers to the frequent lack of an integrated approach to the assessment of design and implementation. The fourth issue is that of hyped media, or the claims made as to the superiority of instructional media. Each of these issues requires a level of attention in the development of any assessment program. Scriven (1986) has characterized traditional social science approaches to assessment as naive and inappropriate. The Annenberg/CPB Flashlight Project which Stephen Ehrmann heads has attempted to develop alternatives to traditional assessment strategies which address some of the obstacles and challenges mentioned above.

> "Ordinarily what matters most is not the technology per se but how it is used; not so much what happens in the moments when the student is using the technology, but more how those uses promote larger improvements in the fabric of the student's education...." (Ehrmann, 1996).

The Annenberg/CPB Project is one effort to address technology and learning implementation strategy. For example, in looking at learning the project suggested that assessment needed to focus on whether the outcomes would produce greater engagement in learning and more productive time on task by students.

An integrated model for evaluating multimedia instruction, outlined by Rathbun and Goodrum (1994), provided the framework for our assessment of LT. A focus on user satisfaction looks first at design issues such as moving about, finding things, and control of

tasks appropriate to the level of the user. Valuing is an essential part of this characteristic and states that a tool can be "viewed as relevant, critical, and of wide applicability... a tool the user will come to rely on" (p. 4). The second characteristic is the integration of evaluation into the design process. Evaluation should lead the process through the development of conceptual prototypes that allow for early assessment and redesign.

The inclusion of a range of stakeholders early in evaluative activities is the third characteristic and allows for the collection of ideas, gains buy-in and commitment, and avoids unforeseen technical and administrative problems (Rathbun and Goodrum, 1994, p. 4). The range of stakeholders should include users, designers, local area network administrators, and others who impacted on the users' access to the program. The fourth characteristic is a suggestion that multiple collection techniques will produce a more complete evaluation than will a single source. This suggestion follows Lincoln and Guba's (1985) proposal that triangulation is a method of improving the probabilities "that findings and interpretations will be found credible" (p. 305). Denzin (1978) identified four basic types of triangulation: (1) data triangulation or the use of a variety of data sources; (2) investigator triangulation using several different researchers or evaluators to look at the same phenomena; (3) theory triangulation where multiple perspectives are used to interpret a single set of data; and (4) methodological triangulation where multiple methods are employed to study a single problem. The development of multiple techniques is both a sound and viable approach to the assessment of multimedia program development and implementation.

Measuring the effectiveness of implementation focused on seeking the answers to four questions. The first question dealt with the usability/accessibility of the multimedia program by students. Usability suggests that the end user finds the program adaptable to their level of competence and experience. Another way to state usability is to imply that users establish a comfort level with the program's operation. The second part of the first question is accessibility and refers to an availability of the program and appropriate hardware to users at times and locations that are convenient to the student's desired schedule. If the program is not readily accessible to students at peak user times or if the hardware cannot support the demands of delivery of the program at peak periods then the notion of accessibility is rejected. A Quicktime video delivered over a local area network needs to provide the user with unfettered delivery of the video. If the video is fragmented or choppy then accessibility could be considered compromised.

The second question is receptivity by users. Another way to explaining receptivity suggests it is a process of valuing on the part of the user. Schon and Bennett (1996) suggest that good programs are "genuinely interactive and conversational" (p. 181). Rathbun and Goodrum (1994) stated "a tool viewed as relevant, critical, and of wide applicability is a tool users will come to rely on" (p. 4). They suggest valuing creates a face validity of the program. Chickering and Ehrmann (1996), reporting on good practices in education view technology as a lever in achieving greater student participation and engagement in learning. Student receptivity, as defined in this paper, seems to increase according to students' perceptions of how "hands-on" a learning activity is. They go on to suggest that active learning falls into "three categories: tools and resources for learning by doing, time-delayed exchange, and real-time conversion" all currently supported by software.

Implementation readiness, the third question, deals with the order and timing of the

presentation of information. Structured within the context of the course the relevancy of the multimedia program is, in part, contingent upon appropriate implementation. Implementation includes some levels of valuing on the part of users, but more directly relates to student readiness to received what the instructor perceives to be appropriately timed and ordered material. The instructor/designer has meaningful control over the implementation readiness. It is not the technology that is important, but how the technology is used to supplement and/or enhance learning (Ehrmann, 1996).

The fourth question asks if the program met the instructional goals established by the instructor. It would seem apparent that any multimedia project would be designed to meet or support instructional goals. Sometimes, however, in the rush to adopt a new instructional methodology instructors forget the purpose and role of the technology.

MEASUREMENT

Students in the senior level course using the LT were expected to have had at least one course introducing them to computers and to have moderate to advanced experience with computers. The class was organized around one lecture and one discussion each week. The lecture section was composed of 60 students and the discussion groups of 20 students each. The lecture section typically presented new material or reinforced material presented in the LT. The discussion groups were utilized to expand lectures through discussion, involve students in practical exercises and discuss implications of information presented in the LT. The LT was intended to provided a foundation for classroom activities.

Implementation of the LT was made via two modes: (1) across a campus-wide local area network; and (2) via CD. It was determined prior to the start of the semester to test the two implementation modes to see if there was any difference in the usability by the two groups and to determine if one mode was more preferable.

Issues of time, resources, convenience, timing issues and the like precluded a complete and thorough pretesting prior to the implementation of the LT. The first semester of implementation of the LT more appropriately represented field testing of the final stages of development. Both the design team and instructor were aware that several questions about implementation remained unanswered and were likely not to be answered in the absence of a full implementation of the program.

Triangulation was used to answer the 4 questions posed about the effectiveness of implementation. Figure 1 illustrates the methodologies utilized in the assessment. Two of the methods involved observation of students using the LT. In one case multiple students were observed using the multimedia program in a laboratory session. In this instance students were observed working through assigned tasks and the observer noted the frequency with which certain tasks were repeated, how students went about using the LT, time it took for students to complete a unit, and interactions between students. The second observation involved two volunteers from the class working individually with an observer through one LT unit. The third data collection method involved the use of two surveys. One was administered 5 weeks into the semester and a second 2 weeks before the end of the semester. A fourth method of analysis involved periodic debriefing the instructors following classroom use of the LT. A fifth artifact was the use of a critical incident questionnaire (Brookfield, 1995)

which was administered periodically during the course. The critical incident questionnaire was not designed to secure information about specific aspects of the LT implementation, but provided additional insights into student perceptions of the usability and receptivity of students.

Assessment Question	Assessment Methodology
Usability of the multimedia by students	Observation of group in computer lab Observation of individual students Survey instrument Debriefing of faculty
Appropriate delivery of the technology to students	Observation of group in computer lab Observation of individual students Survey instrument Debriefing of faculty
Student receptivity to the use of technology to support classroom instruction	Observation of individual students Survey instrument

Figure 1: Assessment questions and methodologies

RESULTS AND DISCUSSION

USABILITY AND ACCESSIBILITY

Perceptions of usability/accessibility of the multimedia project varied considerably. Two factors contributed to student perceptions of usability. Student knowledge of how to use computers and their comfort levels with them was a key factor. The availability of computers at a time that was convenient to the student was also very important.

The usability of the multimedia project was clearly dependent upon student comfort and knowledge of computers. Even though most student were within 2 semesters of graduation (70%) several indicated they were not comfortable with computers. One student who volunteered to test the LT indicated he had a low comfort level with computers. This was evidenced when he reported that his e-mail did not work, and that he checked it only infrequently. He found the multimedia program to be informative and helpful, but had difficulty figuring out how to access it on the local area network. By contrast, another student volunteer reported himself as an above average computer user. He found the LT to be easy to access and to be helpful. In a separate survey it was determined that almost 50% of the student in this senior level course had yet to complete the required sophomore level computer applications course. This unfamiliarity with computers may have led to only 20% of the students in the class suggesting the multimedia project was a good use of their time. Another 36% had no opinion.

Unfamiliarity with computers was only one of several issues that affected perceptions of usability. Some students reported the computer freezing up when they attempted to access

Quicktime movies on a local area network during peak periods. Others reported software failure (most notably Netscape 2.02) when trying to access those portions of the course on the WWW.

Accessibility was an equally difficult issue. Students indicated a problem with the Macintosh only format of the LT. This was evidenced when 51% of the students reported spending 30 minutes or less each week on the LT. During parts of the semester the computer clusters were full with waiting lines. One observation made was the unwillingness of some students to access the LT during non-peak periods. The students suggested they would prefer access to the computer based materials through the use of a CD, used at home, or through the WWW.

RECEPTIVITY

Several valuing issues were apparent from student responses to the questionnaires. Students agreed that those LT units that implemented video aspects to demonstrate management processes were an aid to their understanding of management tasks and functions. In the first survey 41% of the students felt the scenarios were authentic and depicted the situational nature of the manager's job. In the second survey the same question was asked, but asked in conjunction with the worksheets provided in the student workbook. In this case 58% of the students valued the use of the LT, perhaps suggesting that learning by doing and allowing for reflection were important aspects of the implementation process. In addition to the Quicktime based scenarios, written scenarios were present on the WWW and were organized in a script format. Fifty-four percent of the students agreed the web scenarios were an aid to understanding the issues discussed in class. Maybe most importantly was an overwhelming recognition by students of the relevance of the LT units content to their future work lives (71%).

The more often students used the LT and other computer based materials for the course the more comfortable they were with the process. The frustration level among students was much higher earlier in the semester when the process was new to almost all of the students. Later in the semester, the frustration level was significantly reduced. Unfortunately, students who became highly frustrated with the process and exhibited low expectations of their own ability to work with computers had a tendency to become disengaged from this aspect of the course.

One of the late decisions made prior to implementation was the development of a workbook that provided much of the written information found in the LT and included questions, in a WWW format, guiding students through the video and WWW portions of the project. Clearly the addition of written materials designed to supplement and reinforce the LT presentation aided student understanding.

There was a dichotomy between the usability/accessibility and the receptivity of the course among the students. In the former, students found the software relatively unusable and non accessible. Receptivity did not suffer from the same perceptions. It was clear the students valued those portions of the content that connected with their perception of what the real work world is like and how they might work in it. The process of valuing may, in part, have encouraged some students to overcome the usability/accessibility issues. This area obviously deserves more discussion.

IMPLEMENTATION

Schon and Bennett (1996) reported, "It was amazing how much difference there was between the intentions that the faculty had for their software and the experiences that people had using it" (p. 179). This was certainly the case with the LT. Some implementation issues were structured by the availability of technology on campus. Others, however, were dictated by the willingness of students to use technology and their perceptions of the appropriateness of the technology to their future. It was also clear, that in some instances, the student outcomes were frequently not consistent with the expectations of the instructor.

The assessment carried over two semesters and in those instances where it was determined the content was not valued or it did not contribute to student learning, the instructors modified the sequence, timing and delivery, and in several cases this made a significant difference in student receptivity. For example, in a unit where students observed a day in the life of a manager they found it an aid in their understanding of how managers function. The video segment was designed primarily to foster understanding among students with limited knowledge of what managers do. It was suggested that students with a broader base of management experience found this segment less helpful than those with a limited experience base. Debriefing the instructors (a graduate assistant facilitated one of the discussion groups) following the presentation of this particular Quicktime video, it was determined that during the second semester of implementation to stop the video more frequently for discussion. In addition the student workbook was modified so students were asked to look at more concrete types of roles managers engage in and then to think about why they thought those roles appeared. A critical incident questionnaire administered during the second semester had responses suggesting a higher level of understanding among the students.

In another unit focusing on management theory students were exposed to the same scene portrayed in 3 different management styles. The resulting discussion comparing the 3 management styles was confusing for the students. They had difficulty determining how the management styles were different. During the debriefing the instructor suggested that looking at short segments of 3 different management approaches did not provide students with sufficient information to gain an understanding for a particular management approach. Each management style was originally developed with 5 scenes. The following semester the instructor showed all 5 scenes from one management style followed by workbook based questions and classroom discussion. Then the students viewed a second style and the same learning approach was repeated. Student understanding of individual management styles and the differences between styles improved considerably.

INSTRUCTIONAL OBJECTIVES

Measuring the effectiveness of accomplishing instructional objectives was clearly more difficult. At the outset of the project several goals were established. These were previously reported in the discussion of the LT. The first goal was to provide students with an interactive learning environment that would enhance rather than replace the existing classroom. It was found that in some cases this goal was met and in other cases the goal was not met. Students did not perceive the usability/accessibility of the LT to be satisfactory, but did value the content of the video and web-based management exchanges. The goal was partially achieved,

but considerable additional work needs to be done in order to fully attain this goal.

A second goal of the LT was to build the individual student's base of professional experience. The accomplishment of this goal was more difficult to assess. For students who had minimal experience with management it seemed that the LT had the potential for building an individual student's management experience level. For students who had, what they perceived to be, management experience, the evidence was less compelling. More disturbing, however, may be those students who did not believe that the scenarios presented realistically portrayed management tasks or roles.

The third goal focused on enriching student understanding of management as a dynamic rather than static process. The assessment process did not measure accomplishment of this goal. The instructors perceptions of achievement of this goal was mixed. It was felt that more attention needs to be given to this goal before any type of assessment could be made. A fourth goal of the LT project focused on enhancing basic and intermediate computer skills. Using the LT as a foundation, students were also exposed to electronic communications software, the WWW, word processing, spread sheet and graphics software.

REFLECTIONS AND FUTURE ORIENTATIONS

The evaluation paradigm suggested by Rathbun and Goodrum (1994) provided a starting point for our evaluation of an instructional multimedia program. The adoption of triangulation in its various forms as suggested by Denzin (1978) proved to be a viable and potentially effective tool for assessment in this situation. Assessment methods should be unobtrusive and most importantly should be used continuously in order to provide timely information which can be acted on quickly. Using a mix of qualitative and quantitative methods and a variety of researchers helped lessen the burden placed on students, who often "burn out" on course evaluations. The mix of methods used here resulted in students' greater engagement in course content, instructors' increased interest in and improvement of instructional use of materials, and a rich pool of ideas and experiences to use in the refinement and improvement of the product and its future use.

Several implementation issues seemed to dominate the overall context of the assessment. The usability/accessibility of a program is a key factor in producing receptivity. It was evident that in the absence of good usability/accessibility students would not struggle to find relevance. On the other end of the scale, however, those who found relevance tolerated, but did not like, the poor usability/accessibility of the LT.

Related to the usability/accessibility is a suggestion for a more intense early linkage with stakeholders would have been beneficial. Software promises and hardware anticipations didn't materialize, thus reducing the intended delivery capabilities of the LT. A software package was promised that would be cross-platform. Two and one-half years later the promised software is still nowhere in site. Similarly, close cooperation with the hardware stakeholders suggests development of a multimedia program that meets the lowest common denominator. One that can run on an old 486 as well as the new speedier machines. University computer clusters available to students do not always have the most current hardware. The developers need to make sure the software is developed for the least capable computer it will potentially be delivered on.

The learning objectives of the course need to be realistic, based on teaching and design experience, subject to trial and error (learn by doing), and constantly be tested. Many authors have suggested that software development is typically a long term process. With the impact of changing technology, increased demands on the class and software, changes in the design team and the like, it is easy to lose sight of the instructional objectives. While it is believed in this process sight was not lost of the educational objectives, too little trial by error and continuous testing was done. There were several factors that mitigated against this and are likely to occur in most settings of this type. However, in retrospect, ways to do more testing should have been integrated into the design process. It in no way guarantees that the outcomes would have been any different, but it does suggest that the surprises might have been lessened. We suggest a good motto is to experiment, experiment, experiment until you find what works and don't apologize.

The video and WWW segments of the LT were valued by the student users. To be valued, however, they must be connected with classroom discussions and student workbooks. The linkage between the workbooks and the video and WWW segments was not fully explored, but observations of class discussions suggested that for those students who took the time to complete the workbooks there was a stronger engagement in the classroom discussion and with the LT.

Consistent with the above finding was the observation that the students preferred to learn by doing. Learning by doing is an effective active learning technique. When linked with small group discussions it enhances reciprocity and cooperation among students. The LT was designed as a support to a learn by doing classroom and independent process.

What to do next has, in part, been driven by the assessment process. In those instances where students did not find relevance in the LT we need to determine why. In several instances a dissonance was present between the anticipated outcome of the LT unit and the students' perception of the same unit's value to them during the course and into the future. It may be that a more careful review of the existing units that did work and a determination of why they worked will provide important clues about how to improve those units that did not work.

A second issue for future discussion relates to integration, which has to do with external requirements placed on students that are more challenging than the internal requirements of the LT. The goal is for the students to independently recognize the importance of the information contained in the LT as an aid in the achievement of some authentic task. While this work has been going on, there has been no organized effort to address whether it is integrated with the LT or is a stand alone requirement without linkage.

REFERENCES

Brookfield, S. D. 1995. *Becoming a critically reflective teacher* . San Francisco: Jossey-Bass Publishers.

Chickering, A. W. and Ehrmann, S. C., 1996. "*Implementing the seven principles: Technology as a lever* ."

Denzin, N. K. 1978. *Sociological Methods* . New York: McGraw-Hill.

Ehrmann, S. C. 1996. "*The Flashlight Project: Spotting an elephant in the dark* .".

Hutchison, C. 1995. "The 'ICP OnLine': _Jeux sans frontiées on the Cybercampus." *Journal of Computer-Mediated Communication* . 1, (1).

Lincoln, Y. S., and Guba, E. G. 1985. *Naturalistic Inquiry* . Newbury Park, CA: Sage Publications.

McLean, D. D., and Brayley, R. E. 1996. "The computer model as a window to the working world." *TCC-L Journal*

Rathbun, G. A., and Goodrum, D. A. 1994. "Evaluating the impact of instructional multimedia: Workable techniques." Paper presented at the annual conference of The Association for Educational Communications and Technology, Nashville, TN.

Scriven, M. 1986. "Evaluation as a paradigm for educational research. In E. R. House (Ed.), *New directions in educational evaluation* . Philadelphia: Falmer Press.

Schon, D., and Bennett, J. 1996. "Reflective conversation with materials: An interview," in Winograd, T. (ed). *Bringing design to software* . Reading, MA: ACM Press/Addison Wesley Publishing Company.